standard, he will apply the proper correction. In cases of dispute between two laboratories, an analysis by each of the standardized sample, each working by its usual method, will usually lead to a satisfactory agreement.

The materials which it is proposed to standardize fall into two groups. The first group comprises substances to be employed for standardizing volumetric solutions. These may be either the solutions themselves, or compounds of exactly known content used in establishing the true titer of the solutions belonging to the industrialist's laboratory. In the case of about six of the most used and most permanent, it would probably be well to furnish the solutions and also the standard compounds. The second group comprises standardized samples of commercial materials, by the use of which the manufacturer can control his entire analytical process. This work has already been begun. Its development must naturally be slow, since the field is immense, and in some cases special industrial laboratories have perfected methods of analysis which for commercial reasons have never been published and which are superior to those in general use or to those which would be at the command of the bureau. Exceptional cases of this kind need not, however, stand in the way of the adoption of the general scheme. To decide what portion of the whole field should be first occupied and what left to future growth is a matter that would require very careful study and need not be even touched on here. The question whether the standard solutions or substances should be furnished by the consumer and standardized by the bureau or whether they should be furnished outright by the bureau is a matter of detail which practical considerations would settle. The cost of executing such a programe as that suggested need not be a serious obstacle. From the standpoint of the manufacturer it would be economy to pay very liberal fees for the work, especially in view of the fact that the standardized materials would be consumed in small quantities only and mainly for the purpose of establishing secondary standards.

Whether it is desirable for the bureau to undertake to work out standard methods of analysis, is a question that may fairly be looked upon as an open one. For myself I should be inclined to answer it in the negative. The scope of work is wide enough without this. The difficulty which any institution must have in deciding for the industrial laboratory which are the methods that would be practical for it are insuperable. A method that would be eminently practical for one would be the reverse for another having command of facilities more or less wide. Moreover it is impossible for any outsider to know what the analytical problems are which the industrialist has to handle, and in very many cases the latter will on no account furnish the information. Nevertheless, while for the reasons stated, the writer does not believe it to be wise for the bureau to make the investigation of analytical methods a part of its functions, yet it must of necessity investigate many such methods as an incident in the carrying out of other work, and it will, of course, not refrain from giving to the world the benefit of such work by timely publication.

The chemical profession in this country is only now coming to a consciousness of itself. When it has fully done so, it will doubtless have a Bureau of Applied Chemistry of its own, together with other good things, but the day is probably still distant. It owes it to itself, in the meantime, neither to be backward in acknowledging the great work that the Bureau of Standards has already accomplished, nor in demanding that its scope should be extended and its relations be made more intimate with our chemical industries, whose future is already looming up greater than any man can now fully realize or forecast.

Launcelot Andrews

St. Louis,
July 24, 1908

SCIENTIFIC BOOKS

The Work of John Samuel Budgett, Balfour Student of the University of Cambridge. Being a Collection of his Zoological Papers, together with a Biographical Sketch by A. E. Shipley, F.R.S., and Contributions by

RICHARD ASSHETON, EDWARD J. BLES, EDWARD T. BROWNE, J. HERBERT BUDGETT and J. GRAHAM KERR. Edited by J. GRAHAM KERR. Pp. x + 494; 28 plates; 173 figures in the text. Cambridge University Press, 1907.

John Samuel Budgett died January 19, 1904, at the age of thirty-two, from malarial fever contracted during his last and successful expedition to Africa in quest of the long and eagerly sought early development of *Polypterus*. The beautiful volume prepared by his friends and colleagues is a fitting memorial of his life and work and one that stirs a keen sense of the loss that science suffered by his untimely death. A collection of Budgett's own works and of others based on his material is preceded by an excellent biographical sketch by Mr. Shipley. From this we learn that his early interest in natural history was encouraged by his father's friends, Professor W. K. Parker and the Rev. Dr. Dallinger, and later by Dr. Lloyd Morgan, but until his entrance to Cambridge University he was largely self taught. The remarkable abilities he displayed at Cambridge brought him the opportunity to accompany Mr. Graham Kerr on his brilliantly successful expedition to Paraguay in 1896–7, the principal result of which was to make known the development of *Lepidosiren*. On this expedition Budgett gave especial attention to the amphibia, afterwards publishing a valuable account of their breeding habits and of the development of Phyllomedusa. The principal result for him was, however, to arouse his determination to attack the development of the crossopterygians; and to the search for this material the next five years were devoted with indomitable persistency and courage. In the effort to procure the early stages of *Polypterus and Calamicthys,* and also of *Protopterus,* he made four successive expeditions to Africa, the last of which, in 1903, was crowned with success but cost him his life. The first expedition, to the Gambia River in 1898–9, failed in its main object, but in the face of great difficulties the breeding time of *Polypterus* was determined and valuable additions to our knowledge of the fauna of the Gambia were made. In a second attempt, made in the same region during the rainy season of 1900, the nests and larvæ of *Protopterus* were discovered and a single larval stage of *Polypterus* was procured which formed the subject of an important memoir published in 1901. His diaries of the expedition give a vivid impression of the courage and enthusiasm with which he pursued his work in the tropical swamps amid incessant heavy rains, and at times attacked by fever. Upon his return to Cambridge he became assistant curator in the zoological museum and delivered lectures on the geographical distribution of animals. In 1902 he was elected to the Balfour studentship, the "zoological blue ribbon of Cambridge," and, with an additional grant from the Zoological Society, was enabled to embark on a third expedition, to the Victoria Nile. For the third time he failed, but held to his purpose. The final and successful attempt was made in 1903. At Assé, on the river Niger, he at last succeeded in artificially fertilizing the eggs of *Polyterus* and in obtaining a practically complete series of the stages of development. But the climate had done its deadly work. Returning to England be began to work out his results, but suffered from recurrent attacks of malarial fever to which within a few months he succumbed, his death occurring on the very day for which a paper by him on the development of *Polypterus* was announced for the Zoological Society. He had finished his drawings of the external features of the early development, but it remained for Professor Kerr to prepare the sections and work out the results in detail.

In the memorial volume are brought together ten of Budgett's papers, the most important of which deal with the development of the skeleton and urino-genital system in *Polypterus,* the early development of *Protopterus,* and that of *Phyllomedusa.* Other less technical papers deal in an interesting way with the general natural history of the tropical regions that he visited. The remaining papers of the volume, based on Budgett's material, include, among others, Professor Graham Kerr's very valuable memoir on the development of *Polypterus;* another on the develop-

ment of *Gymnarchus* (the first of the Mormyridæ to be made known embryologically) by Richard Assheton; and shorter articles by Mr. Boulenger on the fishes of the Gambia, by Dr. Bles on the development of the Anura; and one by Mr. Browne on a fresh-water medusa, discovered by Budgett in the delta of the Niger, that seems to be identical with the Limnocnida found in Lake Tanganyika. It is impossible here to review the results of these works in detail, but a special word should be spoken in commendation of the excellence, and often the truly artistic quality, of the illustrations, many of which are from Budgett's own drawings.

Budgett showed a rare union of technical skill and morphological insight in laboratory research with uncommon abilities as a field naturalist. His diaries reveal a true lover of nature, one having a wide range of interests in living things, alertly awake to natural beauty, and steadfastly unsparing of himself in the pursuit of his special aim. His was not the only life to be sacrificed in the pursuit of the *Polypterus* development. Nathan R. Harrington died at Atbara in the summer of 1899 while leading an expedition sent out from Columbia University on the same quest. The results attained through Budgett's success are of great and permanent value to science, but they have cost a heavy price.

W.

A Popular History of Astronomy during the Nineteenth Century. By Agnes M. Clerke. New York, The Macmillan Company. 1908. Pp. vi + 489. $2.75 net.

This is a reprint, without change, of the fourth edition, which appeared in 1902 and was widely reviewed at that time. This well-known work is accurate, lucid and interesting. It is already on the shelves of every astronomer's library, but should more universally be found in school and circulating libraries.

It is to be regretted that the few errors and omissions which are to be found in the fourth edition were not corrected in this reprint. Failure in this respect is doubtless due to the lamented death of the author in 1907. The publishers, however, should have had made such obvious and easy corrections as the change in the date of the death of Lassell from 1818 to 1880 (p. 83), and the substitution of the word "gemination" for "germination" when describing the canals of Mars (p. 279), and should have supplied in Table V. the missing but easily obtainable data regarding focal lengths of various telescopes listed therein.

Storrs B. Barrett

SCIENTIFIC JOURNALS AND ARTICLES

The July number (volume 9, number 3) of the *Transactions of the American Mathematical Society* contains the following papers:

W. H. Roever: "Brilliant points of curves and surfaces."

Oswald Veblen: "Continuous increasing functions of finite and transfinite ordinals."

E. J. Wilczynski: "Projective differential geometry of curved surfaces (third memoir)."

A. L. Underhill: "Invariants of the function $F(x, y, x', y')$ in the calculus of variations."

R. G. D. Richardson: "The integration of a sequence of functions and its application to iterated integrals."

SPECIAL ARTICLES

DEGENERATION, ALBINISM AND INBREEDING

In a paper before the American Philosophical Society last spring I showed that often when the two parents have any organ or quality A in two conditions, A + and A —, of which the former is a highly developed or progressive condition, the latter a poorly developed or even absent condition, the former condition will regularly dominate over the latter. In the particular case of human hair color we find, for example, that children are not ordinarily darker than their darker parent. Consequently, if both parents have flaxen hair the children will have hair of the same sort. From this principle, applied generally, it follows that when both parents have an organ in a low condition of development it will be so also in all of their children. This principle explains the persisting or increasing degeneration in the descendants of two degenerate parents.

When one parent has an organ in a minus